these series of low-pressure areas and the general meridional movement of the atmosphere seems to be quite direct. The fact that the low-pressure areas of any series pursue more nearly the same path across the Atlantic than they have pursued across the continent seems to indicate that the change in position of the thermal equator occurs mostly over land areas. It is possible that the meridional motion found over the continental area is compensated by a meridional motion in the opposite direction of [*over*] the oceans.

It is a fact that the cyclones of the North American Continent often occur in series. The first storm of each series runs its course far to the north, and each succeeding one farther and farther south and east usually until the entire continent is passed, after which any subsequent member of the series forms over the Atlantic Ocean.

It should not be understood that the places of first appearance of the cyclones in successive groups are the same, but only that there is a tendency for the subsequent disturbances of a series to run farther to the south and east following the occurrence of the first, a fact that may be verified times almost without number by referring to the charts in the MONTHLY WEATHER REVIEW that show the chronological records of the tracks of cyclones.

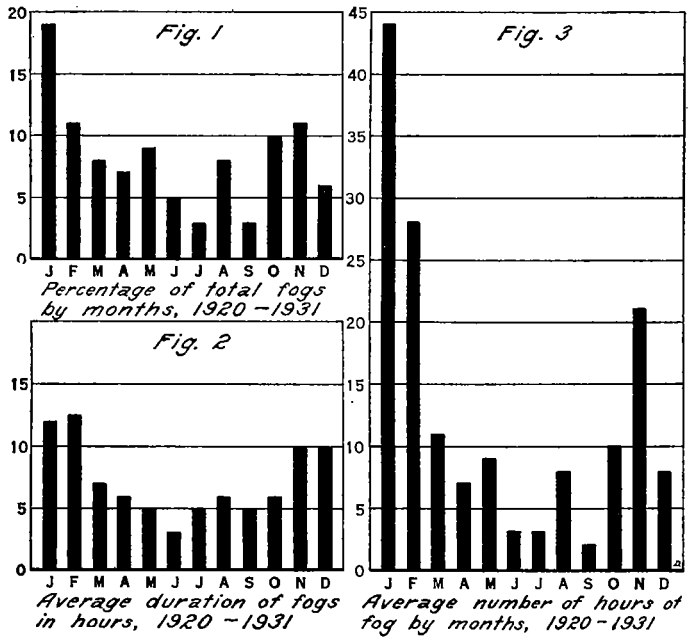
Of all the charts of this kind examined, that of October 1923 best illustrates the tendency of cyclones of the North American Continent to occur in series. This chart of October 1923 is here reproduced in somewhat modified form to bring out the cyclone series of that month in a more detailed way. The first of the cyclone tracks of the series shown is designated *A*, and it lies over British Columbia. Its life on the continent was short, as it was charted for only one observation, that of the morning of the 6th. The second track, designated *B*, starts over Nevada and ends over southern Alberta. The third, *C*, begins over Arizona and ends over northeastern North Dakota. The fourth, labeled *D*, begins over New Mexico, and being long-lived, ends in the region of Hudson Bay. The *E* track begins over the southwest part of the Gulf of Mexico and ends over Missouri, and the *F* following the *E* also begins over the Gulf of Mexico and ends over Ontario; *G* begins in the vicinity of Bermuda and ends near Cape Cod, while the *H* track begins to the southward of Cuba, crosses the coast line near Cape Hatteras, and ends near the mouth of the St. Lawrence River. The *H* track completes the series as far as the North American Continent is concerned. Possibly its continuance on the North Atlantic Ocean could be followed, but the material with which to do this is not available to the author.

An inspection of the chart of cyclone tracks in the MONTHLY WEATHER REVIEW for October 1923 shows that at the time cyclone *F* was forming and passing northward from the Gulf of Mexico, the first cyclone of a new series had appeared in Saskatchewan, followed by the formation of a second of the new series over Nevada and later a third of the series over the upper Rio Grande Valley. Thus it would appear that all of the cyclones of October 1923, between the 6th and the 31st, belonged to two series, the first of which began with *A* on the 6th in British Columbia and ended with *H* on the 26th in the St. Lawrence Valley. The equal of this interesting series is not to be found in the MONTHLY WEATHER REVIEW charts of cyclone tracks for months previous to and following October 1923, although many interesting series are preserved in these charted records.

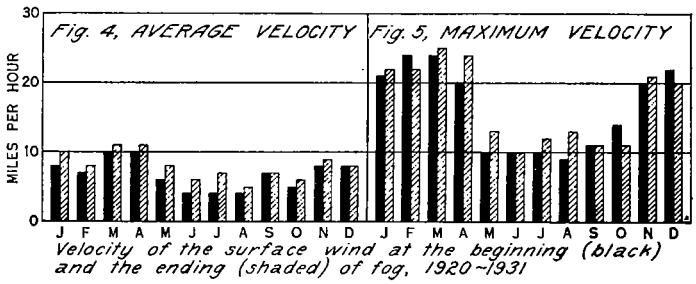
FOG FORMATION AND DISSIPATION IN THE OKLAHOMA CITY AREA, 1920 TO 1931, INCLUSIVE

By PERRY O. EPPERLY
[Weather Bureau, Oklahoma City, Okla., October 1933]

Fog is most frequent in the Oklahoma City area in January and most lasting in February. An average of 44 hours of fog may be expected in January with an average duration of 12 hours. In unusual cases fog has continued with very little variation in intensity for 64 hours. Usually, however, it does not last more than 12 hours. The average number of fogs per day and the average duration of each fog gradually decrease as summer approaches. The minimum average duration is in July and is not more than 3 hours.

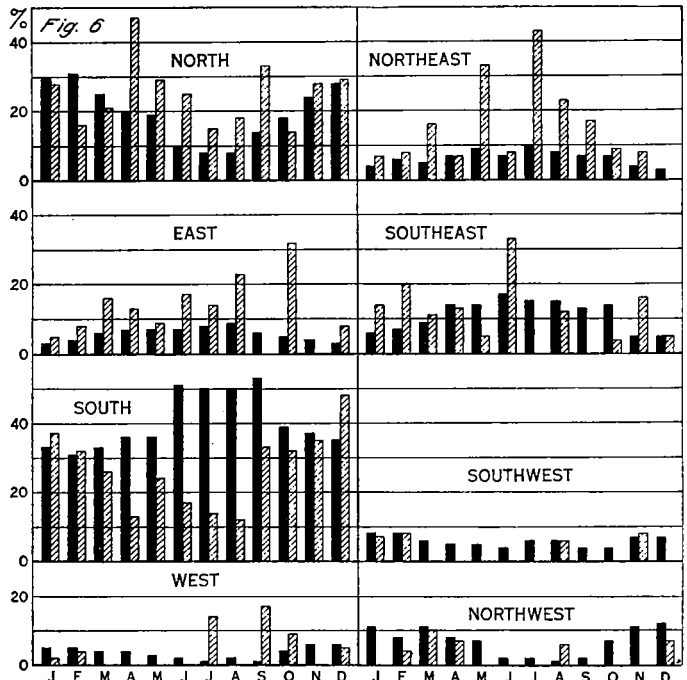


The duration, frequency, and intensity of fog are largely regulated by pressure, temperature, and humidity, though wind direction, sky conditions, and convection currents play an important part in fog formation and dissipation in this area.

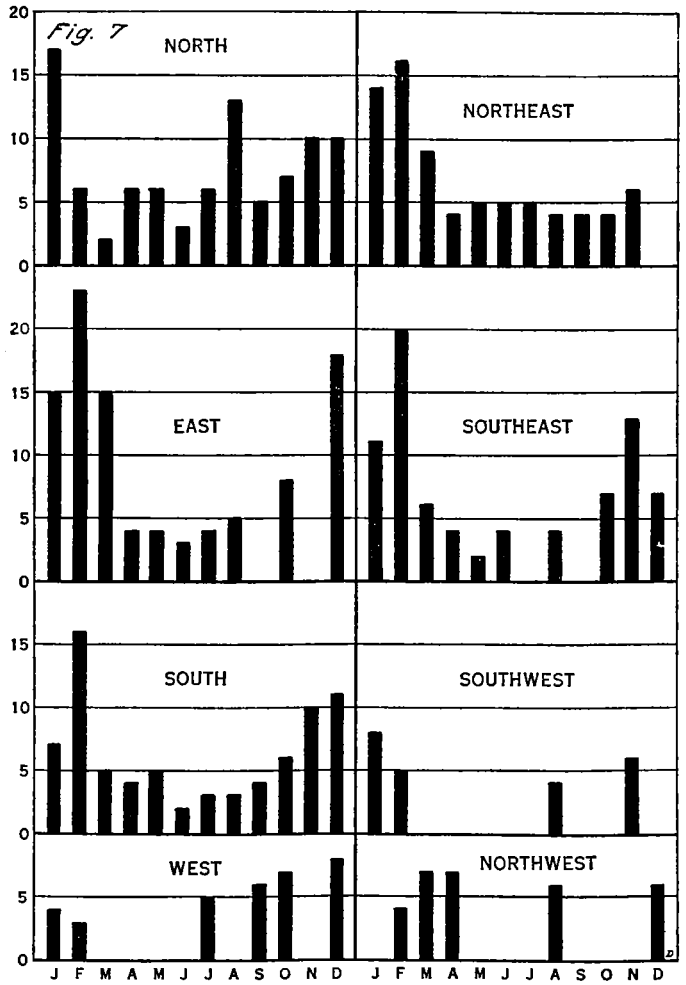


On an average, fog formation occurs when the pressure is steady to rising slowly, temperature falling slowly, and the dew point rising slowly to rapidly. These factors, pressure, temperature, and dew point, tend to remain steady for the duration of the fog.

Variations in the temperature and pressure act directly on the humidity, and cause changes in the density of the fog. A shift of the wind from either south or north to easterly usually intensifies the fog and increases its duration, while a shift to westerly in almost all cases

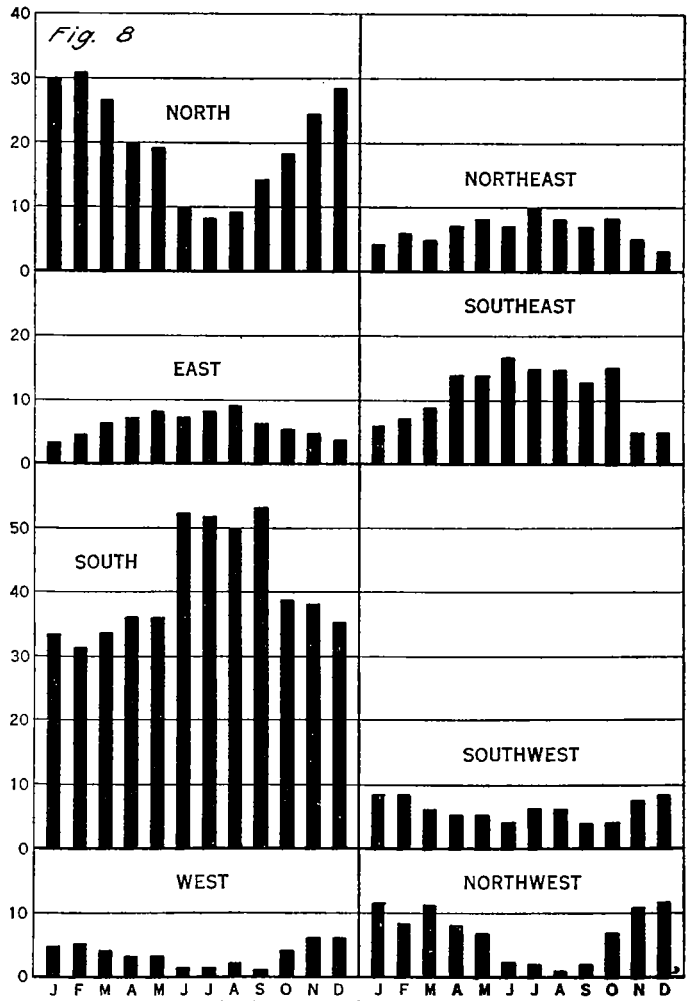


Probability of fog (shaded) and wind (black) occurrence from the different directions

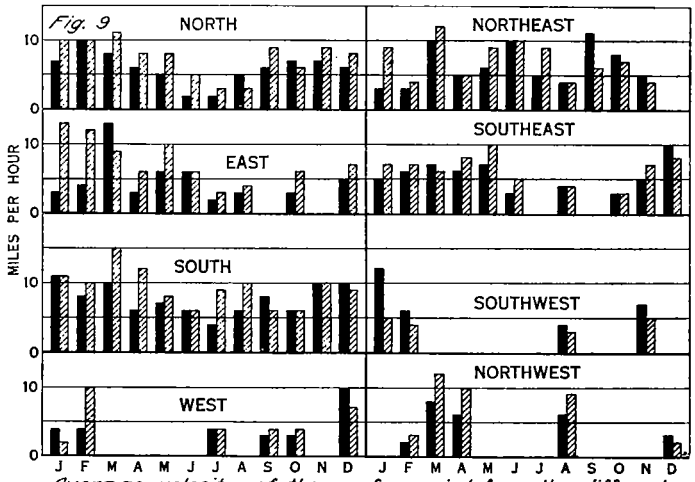


Average duration of fog, in hours, formed on winds from the different directions, 1920 - 1931

brings about its dissipation. An intermediate layer of clouds commonly prolongs the fog, while under a clear sky it will usually dissipate much quicker, especially after sunrise. Convection currents cause the fog to lift, and if the convection is sufficient to cause light to moder-



Percentage of time surface wind blew from the different directions, 1920 - 1931



Average velocity of the surface wind from the different directions at the beginning (black) and the ending (shaded) of fog, 1920 - 1931

ate precipitation, the fog, in most cases, is dissipated by the end of the rain.

All the fog recorded for this area, with very few exceptions, begins between 2 and 7 in the morning. When the sky is overcast and the humidity is high for several hours, or when the area is subjected to several days of moderate rains, fog may be expected to form during the afternoon and evenings.

During the summer most of the fog is of the radiation type. This type, though also occurring tn the winter is most frequent during the spring and in the fall. During clear cool nights when the pressure is steady and the wind light in any direction from south through east to north, fogs are likely to form. If there has been a rainy period of several days they are extremely likely to occur. These fogs generally dissipate soon after sunrise. If there is a cloud covering, dissipation is much slower and the fog may last several hours after sunrise. If the temperature conditions are unfavorable for dissipation, the fog will continue until a decrease in pressure forces it to lift, after which it often remains as low stratus or strato-cumulus clouds.

The surface wind here is westerly a very small percentage of the time and there are but few fogs recorded as then forming. In practically all cases a shift of the wind during fog to a westerly direction has brought about dissipation. It is believed that this dissipation is largely due to warm dry air from the semiarid prairie country to the soughwest, west, and northwest. During the late fall, winter, and early spring, fog may be expected to dissipate before 1 o'clock in the afternoon, while during late spring, summer, and early fall, dissipation will usually occur before 9 in the morning. Under most conditions fogs dissipate with rapid rises in temperature and pressure, however, convection currents cause it to lift and warm dry westerly winds reduce the humidity to such an extent that the fog dissipates.

RAIN-BEARING WINDS OF CENTRAL OKLAHOMA

By PERRY O. EPPERLY

[Weather Bureau, Oklahoma City, Okla., October 1933]

A study of the relation of the rain-bearing winds of central Oklahoma to the prevailing direction of the wind for this area indicates that the wind of rain periods has little relation to the prevailing direction of the surface wind.

During the entire year except February, the prevailing direction of the surface wind is south, however, during late fall, winter, and early spring the wind is north much of the time. In January the percentage of north winds is only slightly below that of winds from the south, while during February they are equal. Through spring and summer the wind is increasingly from the south and reaches a maximum in September. The percentage of westerly winds is slightly larger during the late fall, winter, and early spring than during the summer. During the late spring, summer, and early fall easterly winds, especially northeast and southeast have their greatest percentage.

Although the prevailing direction of the surface wind is south the wind during rain periods is north from September through January to March, equally divided between north and south in April and May, northeast during June and July, and equally divided between north and southeast in August. During April and May rains the wind almost always shifts from south to north and during June and July rains from south to northeast. This is the period of the greatest frequency of thunderstorm development, which accounts for the shift of the wind to the northerly directions. Through the winter months this change of direction during rain periods takes place along the wind-shift line of the numerous low-pressure areas that move over this section of the State.

Thunderstorm development in the winter months is slight; however, an occasional storm is reported in connection with a violent wind shift. From December to February the percentage of rains with thunderstorms is small. From February to May it reaches 68, and in June 80. It then decreases to 71 in September, 51 in October, and 24 in November. The prevailing direction of the upper air for this section is from southwest to northwest during the entire year. Consequently the majority of the thunderstorms occurring at this station move in from these directions.

The prevailing south winds of this area come largely from the subtropical high-pressure area to the south and from anticyclonic systems when they are centered over the southeastern portion of the United States. When these winds blow over the Gulf of Mexico they bring in warm damp air to this section both at the surface and aloft. When this warm damp air associated with the eastern half of a disturbance is underrun by cool air from the northwest and north, showers and thunderstorms occur. When, instead of southerly winds from the Gulf, the air comes as southwest winds from the semiarid desert country, low clouds and fog are dissipated and there is not sufficient moisture present to produce more than widely-scattered precipitation, even when there are underrunning currents of cold air from the northwest. However, when the winds are from the northeast and east, giving cold air near the surface, and they are overrun by south or south-southwest warm, moist air from the Gulf, general precipitation takes place.